## **CLAIMS**

## What is claimed is:

- 1 1. A method for characterizing a drilling hazard in a proposed wellbore, comprising:
- determining a well plan including at least a wellbore trajectory;
- 3 estimating a likelihood of occurrence of, a position along the trajectory and a
- 4 severity of consequences of at least one drilling hazard; and
- 5 displaying on a representation of at least a portion of the wellbore trajectory, at
- 6 least one of the position of, the likelihood and the severity of the at least one drilling
- 7 hazard.
- 1 2. The method as defined in claim 1 wherein the estimating the position, likelihood
- and severity is performed by determining a Bayesian uncertainty thereof based on
- a correlation of the well plan to a model of earth formations along the wellbore
- 4 trajectory.
- 1 3. The method as defined in claim 2 wherein the earth model is generated from at
- 2 least one of offset wellbore data, seismic survey data and correlative wellbore
- data from similar earth formations distal from a location of the proposed wellbore.
- 1 4. The method as defined in claim 1 further comprising:
- 2 adjusting at least one well plan parameter;
- 3 recalculating at least one of the position, the likelihood and the severity of
- 4 the at least one drilling hazard; and
- 5 repeating the displaying.
- 1 5. The method as defined in claim 4 further comprising:
- 2 repeating the adjusting and recalculating until at least one of a most likely
- 3 cost to drill a wellbore, an estimated amount of lost time and a likelihood of
- 4 encountering the at least one drilling hazard is minimized.

- 1 6. The method as defined in claim 4 wherein the at least one well plan
- 2 parameter comprises one of casing depth, dog leg severity, and mud weight.
- The method as defined in claim 4 wherein the at least one well plan
- 2 parameter includes at least one drilling operating parameter.
- 1 8. The method as defined in claim 7 wherein the at least one drilling operating
- 2 parameter comprises at least one of weight on bit and rotary speed.
- 1 9. The method as defined in claim 1 wherein the at least one drilling hazard
- 2 comprises at least one of stuck pipe, lost circulation, taking a kick and BHA
- 3 component failure.
- 1 10. The method as defined in claim 1 wherein the displaying comprises
- 2 presenting a graphic cylinder on the representation at the position, a diameter of
- 3 the cylinder related to the likelihood, a length of the cylinder related to the severity
- 4 and a color of the cylinder related to a type of the at least one drilling hazard.
- 1 11. The method as defined in claim 1 wherein the displaying comprises
- 2 presenting with respect to depth in the wellbore at least one of a color coded and
- 3 shade coded indicator, the indicator corresponding to one of the likelihood of and
- 4 the severity of the drilling hazard.
- 1 12. The method as defined in claim 11 further comprising a reference indicator
- 2 disposed proximate to the at least one of the color coded and shade coded

- 3 indicators, the reference indicator tied to a textual description of at least the type
- 4 of drilling hazard.
- 1 13. A method for optimizing a well plan for a proposed wellbore, comprising:
- 2 selecting an initial well plan comprising at least a wellbore trajectory;
- determining for the initial well plan a position along the trajectory, a
- 4 likelihood of occurrence, and a severity of consequence of encountering at least
- 5 one drilling hazard;
- adjusting at least one parameter of the initial well plan;
- 7 redetermining the position, likelihood and severity of the at least one
- 8 drilling hazard; and
- 9 repeating the adjusting and redetermining until at least one of a most likely
- 10 cost to drill a wellbore, an amount of lost time and a likelihood of encountering the
- 11 at least one drilling hazard is minimized.
- 1 14. The method as defined in claim 13 wherein the determining and the redetermining
- 2 the position, likelihood and severity are performed by determining a Bayesian
- 3 uncertainty thereof based on a correlation of the well plan on a model of earth
- 4 formations along the wellbore trajectory.
- 1 15. The method as defined in claim 14 wherein the earth model is generated from at
- 2 least one of offset wellbore data, seismic survey data and correlative wellbore
- data from similar earth formations distal from a location of the proposed wellbore.
- 1 16. The method as defined in claim 13 wherein the at least one well plan
- 2 parameter comprises one of casing depth, dog leg severity, and mud weight.

- 1 17. The method as defined in claim 15 wherein the at least one well plan
- 2 parameter includes at least one drilling operating parameter.
- 1 18. The method as defined in claim 15 wherein the at least one drilling
- 2 operating parameter comprises at least one of weight on bit and rotary speed.
- 1 19. The method as defined in claim 1 wherein the at least one drilling hazard
- 2 comprises at least one of stuck pipe, lost circulation, taking a kick and BHA
- 3 failure.
- 1 20. The method as defined in claim 13 further comprising displaying in graphic
- 2 form at least one of the position, likelihood and severity of the at least one drilling
- 3 hazard for evaluation by a system operator.
- 1 21. The method as defined in claim 20 wherein the displaying comprises
- 2 presenting a graphic cylinder on the representation at the position, a diameter of
- 3 the cylinder related to the likelihood, a length of the cylinder related to the severity
- 4 and a color of the cylinder related to a type of the at least one drilling hazard.
- 1 22. The method as defined in claim 20 wherein the displaying comprises
- 2 presenting with respect to depth in the wellbore at least one of a color coded and
- 3 shade coded indicator.
- 1 23. A method for drilling a well, comprising
- 2 selecting an initial well plan comprising at least a wellbore trajectory;
- 3 starting drilling the well according to the initial well plan;

4	measuring at least one of a drilling operating parameter and an earth	
5	formation characteristic during the drilling;	
6	determining at least one of a position along the trajectory, a likelihood of	
7	encountering and a severity of occurrence of at least one drilling hazard in	
8	response to the measuring;	
9		adjusting at least one parameter of the initial well plan for an unfinished
10	portion of the well;	
11	redetermining the position, likelihood and severity of the at least one	
12	drilling hazard;	
13		repeating the adjusting and redetermining until for the unfinished portion of
14	the well at least one of a most likely cost to drill, an amount of lost time and a	
15	likelihood of encountering the at least one drilling hazard is minimized; and	
16		drilling the unfinished portion of the well according to the adjusted well
17	plan.	
1	24.	The method as defined in claim 23 wherein the determining and redetermining the
2		position, likelihood and severity are performed by determining a Bayesian
3		uncertainty thereof based on a correlation of the initial well plan to a model of
4		earth formations along the wellbore trajectory.
1	25.	The method as defined in claim 24 wherein the earth model is generated from at
2		least one of offset wellbore data, seismic survey data and correlative wellbore
3		data from similar earth formations distal from a location of the proposed wellbore
1	26.	The method as definer in claim 25 wherein the earth model is redetermined
2	using data from the measuring, and the Bayesian uncertainty is determined by	
3	correlating the adjusted initial well plan to the redeterdmined earth model.	

- 1 27. The method as defined in claim 23 wherein the at least one well plan
- 2 parameter comprises one of casing depth, dog leg severity, and mud weight.
- 1 28. The method as defined in claim 23 wherein the at least one well plan
- 2 parameter includes at least one drilling operating parameter.
- 1 29. The method as defined in claim 28 wherein the at least one drilling
- 2 operating parameter comprises at least one of weight on bit and rotary speed.
- 1 30. The method as defined in claim 23 wherein the at least one drilling hazard
- 2 comprises at least one of stuck pipe, lost circulation, taking a kick and BHA
- 3 failure.
- 1 31. The method as defined in claim 23 further comprising displaying in graphic
- 2 form the position, likelihood and severity of the at least one drilling hazard for
- 3 evaluation by a system operator.
- 1 32. The method as defined in claim 31 wherein the displaying comprises
- 2 presenting a graphic cylinder on the representation at the position, a diameter of
- 3 the cylinder related to the likelihood, a length of the cylinder related to the severity
- 4 and a color of the cylinder related to a type of the at least one drilling hazard.
- 1 33. The method as defined in claim 31 wherein the displaying comprises
- 2 presenting with respect to depth in the wellbore at least one of a color coded and
- 3 shade coded indicator.